

## UIC Permit Application Review Timeline

- 1<sup>st</sup> Class III permit application - Dec 24, 2008/Admin Complete Letter Jan 2009
- 1<sup>st</sup> Class V permit application – Mar 30, 2010/Admin Complete Letter April 2010
  - Admin review is a cursory review to determine if all sections required in UIC regs are present.
  - The UIC regs set a 30 day deadline for this review.
  - A permit application may be administratively complete, but still be technically incomplete.
- Neither of the permit applications were technically complete.
- Centennial, Colorado Class V permit application withdrawn – April 2011
- Updated Class V Permit Application – Jan 2012
- Revised Class III Permit Application – July 2012
- Updated Class III Permit Application – Jan 2013
- One FTE for both permitting actions and aquifer exemption
- Independent EPA reference searches
- Iterative ORC reviews
- Two Regional Applied Research Efforts focused on geochemical compliance at aquifer exemption boundary:
  1. 1<sup>st</sup> one assisted with permit application review & informed permit requirements  
Resulted in field visits with SD DENR & web conferences with NRC & DENR
  2. 2<sup>nd</sup> one informed permit requirements & will assist in addressing public comments
- Followed NRC Actions:
  - Environmental and Technical Reports, Supplemental Reports
  - Requests for Additional Information
  - SEIS – Draft (Nov 2012) and Final (Jan 2014)
  - Safety Evaluation Report – March 2013
  - NHPA 106 Process – Programmatic Agreement signed April 2014
- Followed South Dakota DENR Actions
  - Groundwater Discharge Permit
  - Large Scale Mine Permit
  - Two Water Rights Applications for Inyan Kara and Madison Aquifers
- 40 CFR Part 192 update of EPA regs enforced by the NRC – proposals released Oct 2013 & March 2014
- Goliad Decision and Capture Zone Analysis – June 2014

# Dewey Burdock

## Uranium ISR Project Briefing: EPA UIC Proposed Actions"

- Class III area permit  
(In-situ recovery of uranium)
- Area aquifer exemption
- Class V area permit  
(waste disposal)
- No aquifer exemption

Class III - injection zone is USDW; Class V - injection zones not expected to be USDWs

## Area Permit Requirements

- Area permits must specify:
  - Portion of aquifer where injection is allowed.
  - Construction, operation, monitoring, reporting and plugging requirements for all wells under the permit.
- Allows construction, operation, and plugging of wells within the permit area provided:
  - The Director is notified
  - Area permit requirements are met
  - The cumulative effects of drilling and operation are considered by the Director during evaluation of area permit application and are acceptable to the Director.

UIC regs allow area permits covering more than one injection well

## Area Permit Requirements

- If the Director determines that cumulative effects are unacceptable, he may not issue the permit as proposed by the permittee.
- Once permit is issued, if the Director receives information that cumulative effects are unacceptable the permit may be modified under 144.39.

## How the Class III and V Permits protect USDWs

We will cover the following permit requirements:

- Information gathering and aquifer characterization/submittal prior to authorization to inject
- Well construction and mechanical integrity requirements
- Operational requirements
- Monitoring requirements
- Requirements for plugging and abandoning of wells

After final permit is issued, it is actually just a permit to construct injection wells & does not auth injection.

### Class III Area Permit

#### Requirements to receive authorization to inject

- Delineate wellfield by drilling and logging to determine:
  - Horizontal and vertical extent of ore deposits and proposed injection intervals
  - Presence and thickness of overlying confining zones
  - Presence and thickness of overlying and underlying aquifer units needing monitoring wells
  - Location of proposed injection, production and monitoring wells
- Design wellfield monitoring system
  - Maps/narrative/construction reports for wells penetrating injection zone
- Construct and log all pump test wells
- Measure potentiometric surface levels for baseline
- Begin sampling for baseline water quality
- Conduct pump testing

Explain why pump tests are done & what potentiometric surface is. 14 wellfields, 100s of wells per wellfield

# Timeline for Development of 4 Dewey Area Wellfields

YEAR			1	2	3	4	5	6	7	8	9	10	11	12	13	
D	1	Construction														
		Production														
		Restoration														
		Stability Monitoring														
		Regulatory Signoff														
		Decommissioning														
D	2	Construction														
		Production														
		Restoration														
		Stability Monitoring														
		Regulatory Signoff														
		Decommissioning														
D	3	Construction														
		Production														
		Restoration														
		Stability Monitoring														
		Regulatory Signoff														
		Decommissioning														
D	4	Construction														
		Production														
		Restoration														
		Stability Monitoring														
		Regulatory Signoff														
		Decommissioning														
YEAR			1	2	3	4	5	6	7	8	9	10	11	12	13	

Site	WF	Operational Phase	Project Year												
			1	2	3	4	5	6	7	8	9	10	11	12	13
B	1	Construction													
		Production													
		Restoration													
		Stability Monitoring													
		Regulatory Support													
B	2	Construction													
		Production													
		Restoration													
		Stability Monitoring													
		Regulatory Support													
B	3	Construction													
		Production													
		Restoration													
		Stability Monitoring													
		Regulatory Support													
B	4	Construction													
		Production													
		Restoration													
		Stability Monitoring													
		Regulatory Support													
B	5	Construction													
		Production													
		Restoration													
		Stability Monitoring													
		Regulatory Support													
YEAR		Construction													
		Production													
	B	6	Restoration												
			Stability Monitoring												
			Regulatory Support												
			Recommissioning												
			Construction												
	B	7	Production												
			Restoration												
			Stability Monitoring												
			Regulatory Support												
			Recommissioning												
	B	8	Construction												
Production															
Restoration															
Stability Monitoring															
Regulatory Support															
B	9	Construction													
		Production													
		Restoration													
		Stability Monitoring													
		Regulatory Support													
B	10	Construction													
		Production													
		Restoration													
		Stability Monitoring													
		Regulatory Support													
YEAR		Construction													

Timeline for Development of  
10 Burdock Area Wellfields



### Class III Area Permit

For each wellfield Powertech must submit the following to EPA:

1. Detailed wellfield maps showing ore zones and locations of production and injection wells and all monitoring wells.
2. Geologic cross sections showing ores zones vertically with screened intervals of production and injection wells and all monitoring wells.
3. Maps showing thickness of the injection interval and the first confining zone overlying and underlying the injection interval.
4. Well completion reports and mechanical integrity test dates and results.
5. Discussion of how pump testing was performed.
6. Discussion of the pump testing results including aquifer properties and raw data for EPA to evaluate.
7. Evaluation results of all nearby water supply wells.

A description of the proposed wellfield, including a map delineating the ore zones, color-coded to differentiate the different ore levels within the injection interval.

Map(s) showing the proposed production and injection well patterns and locations of all monitoring wells.

Geologic cross sections and cross section location map.

Isopach maps of the injection interval and the first confining zone overlying and underlying the injection interval.

Discussion of how pump testing was performed, including well completion reports and mechanical integrity test dates and results.

Discussion of the results and conclusions of the pump testing, including pump testing raw data, drawdown match curves, potentiometric surface maps, water level graphs, drawdown maps and, when appropriate, directional transmissivity data and graphs.

Water level drawdown data demonstrating that each well in the injection interval perimeter monitoring well ring is in communication with the wellfield injection and production wells.

The results of the evaluation of all nearby water supply wells with the potential to be impacted by ISR operations or the potential to interfere with ISR operations and the plan for replacing all wells removed from service.

A corrective action plan (required under Part III) identifying areas where breaches in the overlying or underlying confining zones were detected and describing how breaches were mitigated to prevent the migration of injectate and formation fluids out of the ore zone.

A description of any wellfield operational controls designed to contain Injectate and injection interval fluids to the injection interval to address breaches in the confining zones that cannot be located and for which operational controls is the method of corrective action.

The results from the formation testing required in Table 4

The calculated formation fracture pressure for the injection wells connected to each header house and the designated maximum injection pressure for each header house.

Groundwater quality data and baseline water quality standards for wellfield and injection interval perimeter monitoring wells ring wells. Identify any injection interval perimeter monitoring ring wells located in an ore deposit and the baseline water quality standards for those wells.

### Class III Area Permit

For each wellfield Powertech must submit the following to EPA:

8. Demonstration that each well in the injection interval perimeter monitoring well ring is in communication with the wellfield injection and production wells.
9. A corrective action plan identifying any detected confining zones breaches and describing mitigation.
10. Wellfield operational controls designed to address confining zones breaches that cannot be repaired.
11. Calculated formation fracture pressure and designated maximum injection pressure.
12. Groundwater quality data.
13. Water level measurements in all pump test wells.
14. Mechanical integrity demonstration for wellfield injection and production wells.

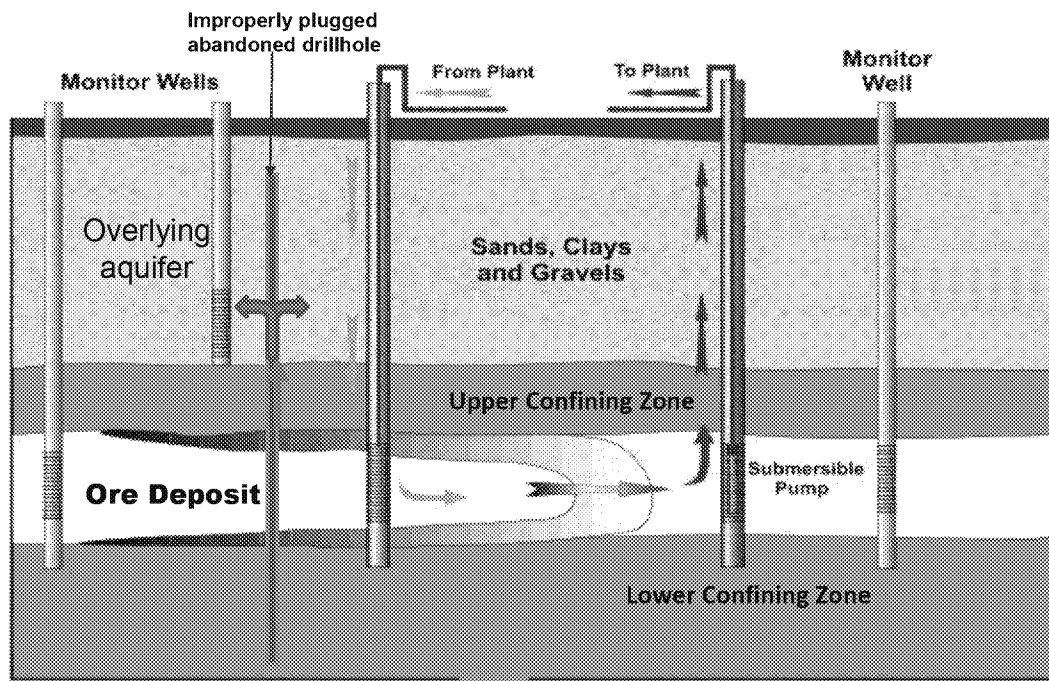
Class III Area Permit  
EPA Evaluation of Information Submitted by Powertech

For EPA to Authorize Injection for a wellfield:

1. Injection zone monitoring wells hydraulically connected to wellfield production and injection wells.
2. Aquifer properties.
3. Confining zones provide vertical confinement of injection interval.
4. Corrective action to assure hydraulic control of injection interval fluids.
5. The number and location of monitoring wells
  - a. meet permit requirements,
  - b. provide indication of hydraulic control of injection interval fluids and
  - c. detect potential excursions.
6. Mechanical integrity of wellfield injection and production wells.

Add timeline for each wellfield, show confinement zone & leak

## Example of Breach in Confining Zone



Historic drillholes

## Corrective Action

- “If needed” permit conditions.
- Designed to mitigate any conduits to surrounding USDWs.
- Remedial actions for water supply wells plugged and abandoned or recemented if needed to be used for monitoring.
- Identified confining zone breaches are repaired or operational controls used to contain injection interval fluids
- Report must be submitted to EPA

Class III Area Permit

## Well Construction

- Casing and cementing requirements
- Well screen limited to injection interval
- Manifold monitoring requirements
- Requirement for installation of automated monitoring and shutdown systems

Manifold monitoring, unique to Class III wells. Instead of monitoring each well individually, 80 wells connected to one header house manifold.

Regs say Separate monitoring systems for each well are not required provided the owner/operator demonstrates that manifold monitoring is comparable to individual well monitoring.

## Operational Requirements

- Injection interval limitation
- Injection pressure limitation
- Requirement to maintain hydraulic control
- Injection fluid limitation (what can be injected)
- Demonstration of mechanical integrity – initial, every 5 years afterward and after well repairs.

Explain what hydraulic control means

## Class III Area Permit

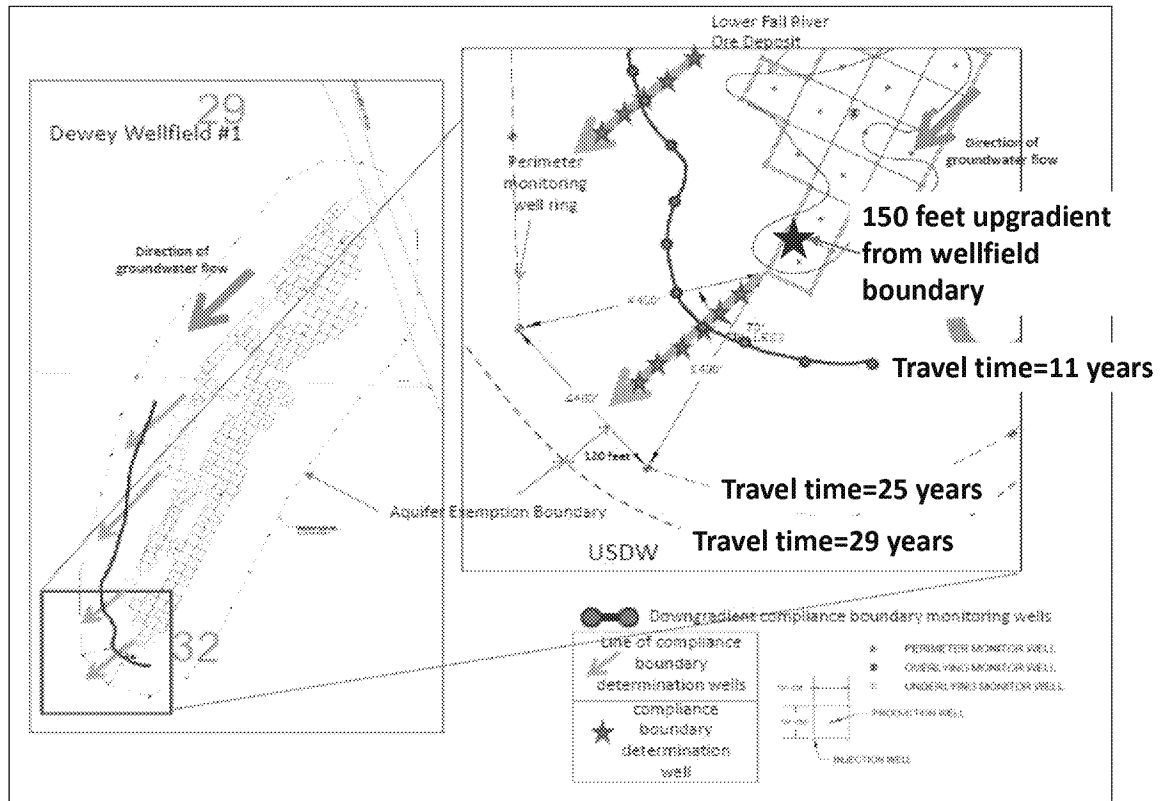
# Monitoring Requirements

- During operation
  - Designed to verify the absence of significant fluid movement through the confining zones
  - Continuous monitoring of injection pressure at header house
  - Continuous monitoring of injection volume and production flow rates
  - Excursion monitoring
  - Operational monitoring
- Post-restoration monitoring – must be designed to verify that no contaminants will cross the AE boundary

Explain that excursion monitoring is for vertical or horizontal movement out of injection zone. Not a violation of permit. Allows for early detection and operator response before excursion becomes violation. Explanation of post-restoration monitoring next slide.



# Example of Post-restoration Monitoring



# Class III Area Aquifer Exemption

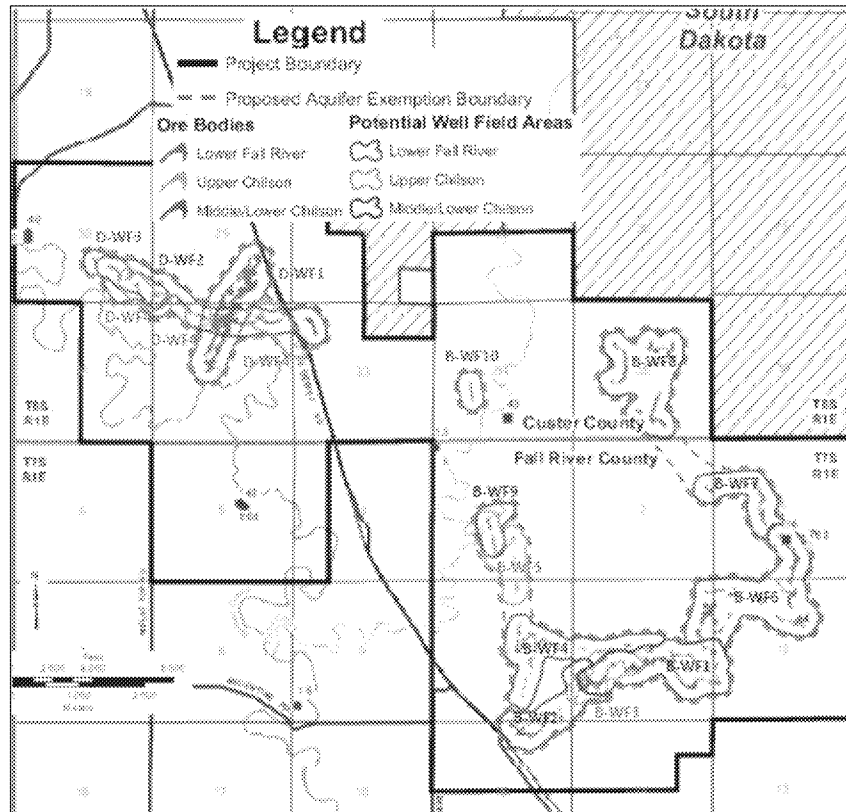
- Is made up of three separate areas
- Inyan Kara aquifers
- Criteria 146.4(a) “not currently a source for drinking water” and (b)(1) “commercially producible minerals”
- Demonstration that injectate will stay within the AE area
- Current source issue resolved
- Capture zone analysis

Explain what the current source issue was & how it was resolved.

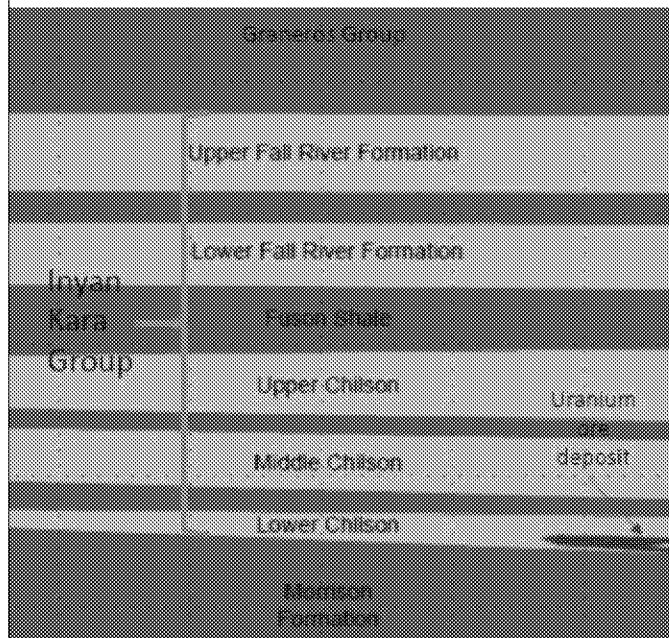
Originally agreement with well owner not to use well for drinking water, Powertech drilled a new well, then supplied bottled water for drinking.

3 steps: disconnect well from house, reclassify well with SD State Engineer, document source of drinking water. Will drill Madison well once operation becomes active & water rights permit is approved.

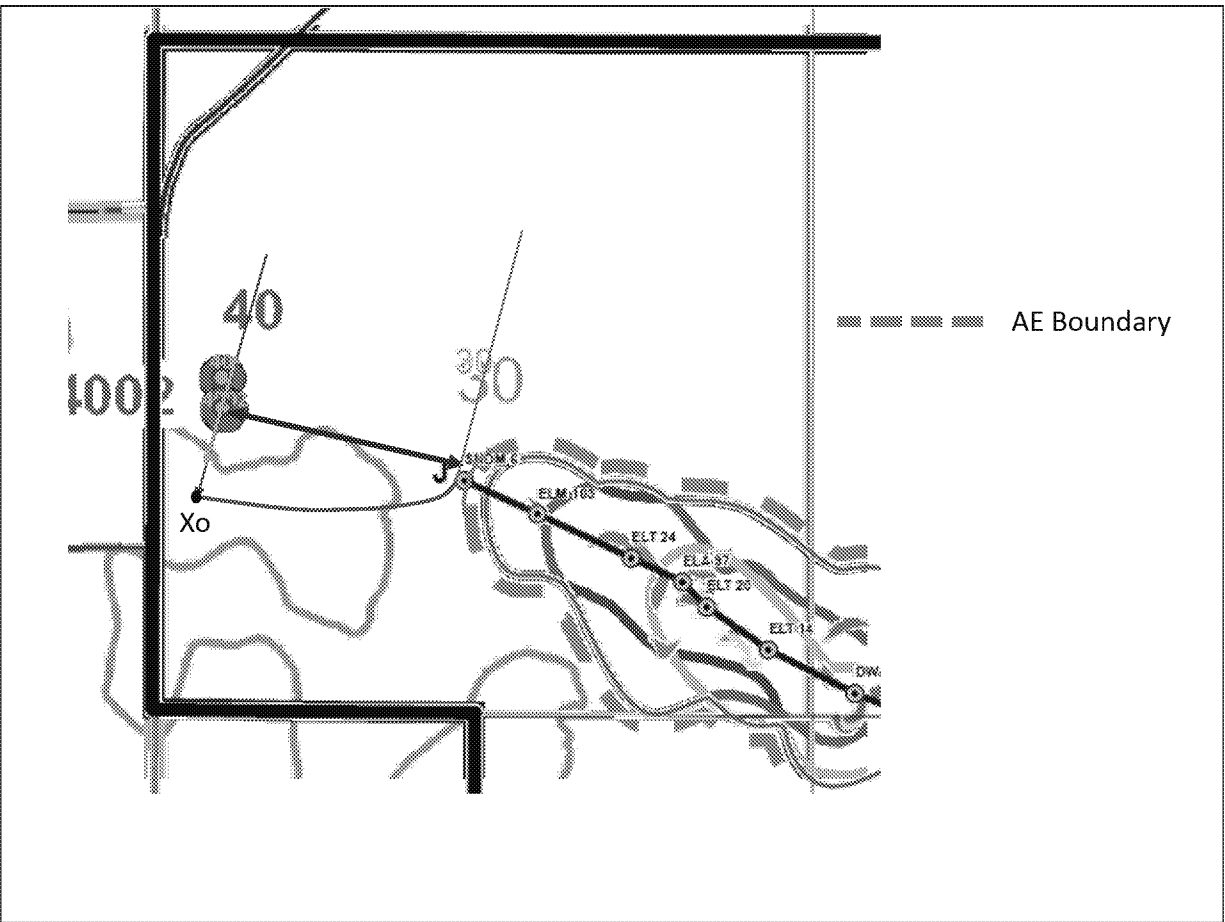
## Proposed AE Area



## AE Vertical Extent



**Ex. 5 Deliberative Process (DP)**



## Class V Area Permit for Deep Class V Disposal Wells

- For disposal of ISR processing waste fluids
- Usually radioactive waste; UIC regs require disposal into a Class I well.
- These wells are Class V wells, because 1 injection zone above a USDW & for injection zone below USDW, because Class I disposal is prohibited in South Dakota.
- Class V permit requires treatment: radium removal ponds
- Powertech believes receiving aquifers are not a USDWs. No water quality data until after permit is issued to confirm.
  - If it is a USDW, this permit *does not* authorize injection; Powertech would need a permit modification and an aquifer exemption (or treat to MCLs or baseline)
- Authorizes up to 8 wells; only 4 proposed at this time.

Class V Area Permit

## How it protects USDWs

- Only authorizes injection into non-USDW
- Information gathering/submittal prior to limited authorization to inject (e.g. – confirming confinement from USDWs)
- Uses limited authorization to inject to conduct necessary tests
- Submit tests results for EPA review to receive authorization to inject
- Well construction requirements and mechanical integrity
- Operational requirements
- Monitoring requirements
- Plugging and abandonment requirements

What is injectate

Class V Area Permit  
Requirements for Powertech to obtain  
Limited Authorization to Inject

1. Well logging information, formation testing data and laboratory data from drillhole core demonstrating the injection zones are separated from underground sources of drinking water (USDWs) by confining zones identified in well logs and are demonstrated to have low permeability and hydraulic conductivity.
2. Water quality evaluation of the Ex. 5 Deliberative Process (DP) Minnelusa porosity zone and Madison Formation aquifer fluids to confirm the injection zones formations are hydraulically isolated from the Madison aquifer at the Dewey Burdock Project Site.
3. The Total Dissolved Solids (TDS) concentration of the injection zone aquifer fluids in order for the Director to determine that each injection zone is *not* a USDW. If injection zone TDS is less than 10,000 mg/L, the injection zone is a USDW. The Director will not authorize injection into a USDW under this Area Permit.



Class V Area Permit  
Requirements for Powertech to obtain  
Limited Authorization to Inject

4. Evaluation of the Madison Formation to determine the Madison aquifer top and bottom and potentiometric surface elevation at the Dewey Burdock Project Site.
5. Calculations of critical pressures and injection-induced injection zone pressures for each injection zone based on site-specific information and  years of injection activity. This information shall be used to demonstrate that each injection well is located a sufficient distance from any feature that has the potential to serve as a migration pathway for injection zone fluids to move out of the injection zone.
6. Well construction completion report using EPA Form 7520-9 containing information demonstrating that each injection zone is isolated from USDWs by adequate well casing and cement.
7. Well perforations are located within the approved injection zone.
8. Demonstration of internal and external mechanical integrity for each injection well.

### Class V Area Permit

Powertech must demonstrate the following to obtain limited authorization to inject:

- Must demonstrate the injection zone is not a USDW
- The injection zone top and bottom must be identified in the well logging results
- The well perforations must be in the injection zone and at least 50 feet below the lowest overlying USDW at the well site
- Must demonstrate presence, thickness of confining zones and integrity
- Injection zone critical pressure evaluations

Critical pressure evaluations to demonstrate that Injectate will not flow upgradient to a fault into overlying USDWs

## Class V Area Permit

### Required tests under limited authorization to inject

- **Step rate test** Provides injection zone fracture pressure
- **Radioactive tracer survey**
  - Demonstrates external mechanical integrity
- **What must we find to issue an ATI?**
  - MAIP permit limit from Step Rate Test results
  - No significant fluid movement through confining zones from Radioactive Tracer Survey

Class V Area Permit

## Well Construction Requirements

- Class I well construction standards
- Surface casing 50 ft below lowest USDW
- Cement outside longstring casing a minimum of 250 ft above injection zone per 40 CFR §147.2104 (d)4 (Powertech proposes 630 ft above injection zone; Permit requires that.)
- Continuous monitoring and automatic shut-off devices

Have a well diagram to show

## Class V Area Permit

### Operational Requirements

- Fluid-filled annulus with constant pressure maintained at 100 psi above injection pressure
- Continuous monitoring of annulus pressure
- MAIP permit limit set at 90% of fracture pressure determined from Step Rate Test
- Injectate specific gravity limit (SG affects injection pressure at injection zone depth)
- Injectate must be treated to meet NRC radioactive waste standards and EPA hazardous waste standards
- External and internal mechanical integrity is required to be maintained at all times.

Class V Area Permit

## Monitoring Requirements

- Annual pressure fall-off test to monitor the pressure buildup in the injection zone
- Seismic monitoring
- Mechanical integrity test every 5 years
- Continuous monitoring of annulus pressure, which is a indicator of internal mechanical integrity.
- Continuous automated monitoring which will shut down injection if MAIP is exceeded or if annulus pressure not maintained.

## **Ex. 5 Deliberative Process (DP)**

## **Ex. 5 Deliberative Process (DP)**



## **Ex. 5 Deliberative Process (DP)**